



MISSION

NAVFAC Environmental Restoration delivers sustainable, innovative, cost effective remediation solutions with stakeholder engagement, to protect human health and the environment, maintain regulatory compliance, and maximize reuse of DON assets to support the warfighter.

VISION

NAVFAC Environmental Restoration is the recognized Federal leader for responsive, best value, and sustainable remediation solutions.

Navy's Approach to Green and Sustainable Remediation

Kim Brown, M.S., P.E.
NAVFAC HQ
E2S2 Conference
May 9-12, 2011

| Report Documentation Page | | | | Form Approved OMB No. 0704-0188 | |
|--|------------------------------------|-------------------------------------|---|---|---------------------------------|
| Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. | | | | | |
| 1. REPORT DATE MAY 2011 | | 2. REPORT TYPE | | 3. DATES COVERED 00-00-2011 to 00-00-2011 | |
| 4. TITLE AND SUBTITLE Navy's Approach to Green and Sustainable Remediation | | | | 5a. CONTRACT NUMBER | |
| | | | | 5b. GRANT NUMBER | |
| | | | | 5c. PROGRAM ELEMENT NUMBER | |
| 6. AUTHOR(S) | | | | 5d. PROJECT NUMBER | |
| | | | | 5e. TASK NUMBER | |
| | | | | 5f. WORK UNIT NUMBER | |
| 7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Facilities Engineering Command HQ,1322 Patterson Ave. SE, Suite 1000,Washington Navy Yard,DC,20374-5065 | | | | 8. PERFORMING ORGANIZATION REPORT NUMBER | |
| 9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) | | | | 10. SPONSOR/MONITOR'S ACRONYM(S) | |
| | | | | 11. SPONSOR/MONITOR'S REPORT NUMBER(S) | |
| 12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited | | | | | |
| 13. SUPPLEMENTARY NOTES Presented at the NDIA Environment, Energy Security & Sustainability (E2S2) Symposium & Exhibition held 9-12 May 2011 in New Orleans, LA. | | | | | |
| 14. ABSTRACT | | | | | |
| 15. SUBJECT TERMS | | | | | |
| 16. SECURITY CLASSIFICATION OF: | | | 17. LIMITATION OF ABSTRACT Same as Report (SAR) | 18. NUMBER OF PAGES 24 | 19a. NAME OF RESPONSIBLE PERSON |
| a. REPORT unclassified | b. ABSTRACT unclassified | c. THIS PAGE unclassified | | | |

➤ Introduction

Incorporating GSR Strategies Into Navy Response Actions

Tools and Tracking

Examples of GSR at Navy Installations

Summary

- **GSR considers non-traditional impacts**
- **Incorporate GSR into cleanup within the NCP framework**
- **Remain focused on cleanup goals, budget, and RIP/RC dates**
- **Navy Policy requires optimization at the remedy selection, design, and RA-O phases and being updated to include GSR**
- **Navy Optimization Workgroup currently developing GSR Guidance**
- **Updated Optimization Policy and GSR guidance document expected to be finalized Spring 2011**

Introduction

- **Incorporating GSR Strategies Into Navy Response Actions**
 - **Optimization Framework**
 - **Overview of GSR Related Updates to Navy Policy**
 - **GSR Guidance Document**

Tools and Tracking

Examples of GSR at Navy Installations

Summary

Incorporating GSR Strategies Into Navy Response: Optimization Framework

Optimization Objectives:

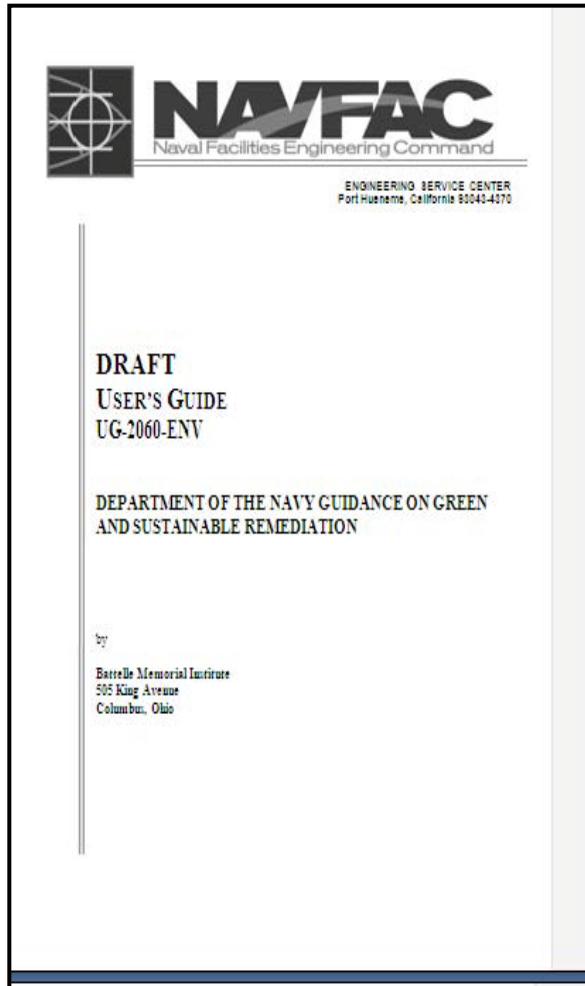
- **Select appropriate remedies/technologies**
 - Technologies that fail to meet established performance objectives and remedies are not sustainable
- **Optimize the remedy**
 - An optimized remedy is a green and sustainable remedy
- **Understand the footprint of the remedy**
 - *Remedy footprint* is meant to include adverse impacts on environmental media and society that are a direct or indirect consequence of performing the remedial action.

Overview of GSR Related Updates to Optimization Policy



- **Navy Policy expanded to include:**
 - **Optimization includes GSR: Evaluate opportunities during all ER Program phases**
 - **Conduct a remedy footprint analysis using the SiteWise tool**
 - **GSR metrics shall be incorporated into the review of the CERCLA Nine-Criteria**
 - **Optimization Tracking to include GSR Metrics**

Incorporating GSR Strategies Into Navy Response: GSR Guidance Document 2011

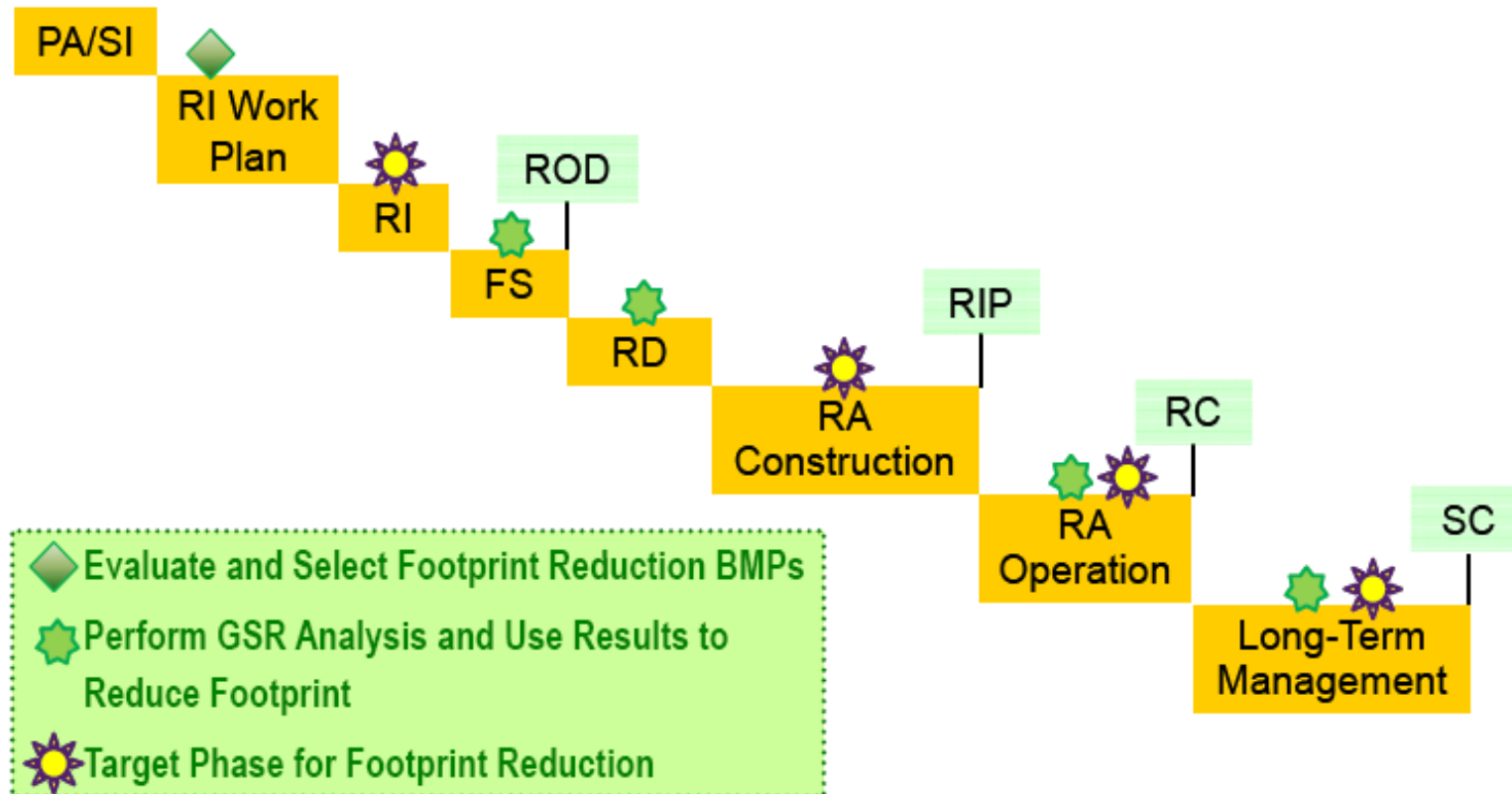


- **GSR Metrics (Section 2.0)**
- **Metric Calculation Methods and Tools (Section 3.0)**
- **GSR during Site Characterization (Section 4.0)**
- **GSR during Remedy Selection (Section 5.0)**
- **GSR during Remedial Design and Construction (Section 6.0)**
- **GSR during Remedial Action – Operation and Long Term Monitoring (Section 7.0)**
- **General Footprint Reduction Methods (Section 8.0)**

Incorporating GSR Strategies Into Navy Response: Remedial Process



Applying GSR Throughout the Remedial Process



Presentation Outline

Introduction

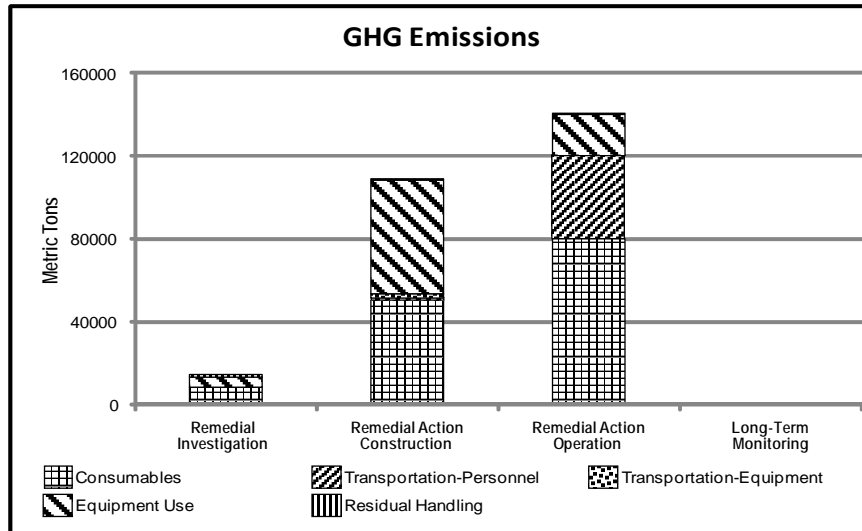
Incorporating GSR Strategies Into Navy Response

➤ Tools & Tracking

- SiteWise™
- NORM
- GSR Portal

Examples of GSR at Navy Installations

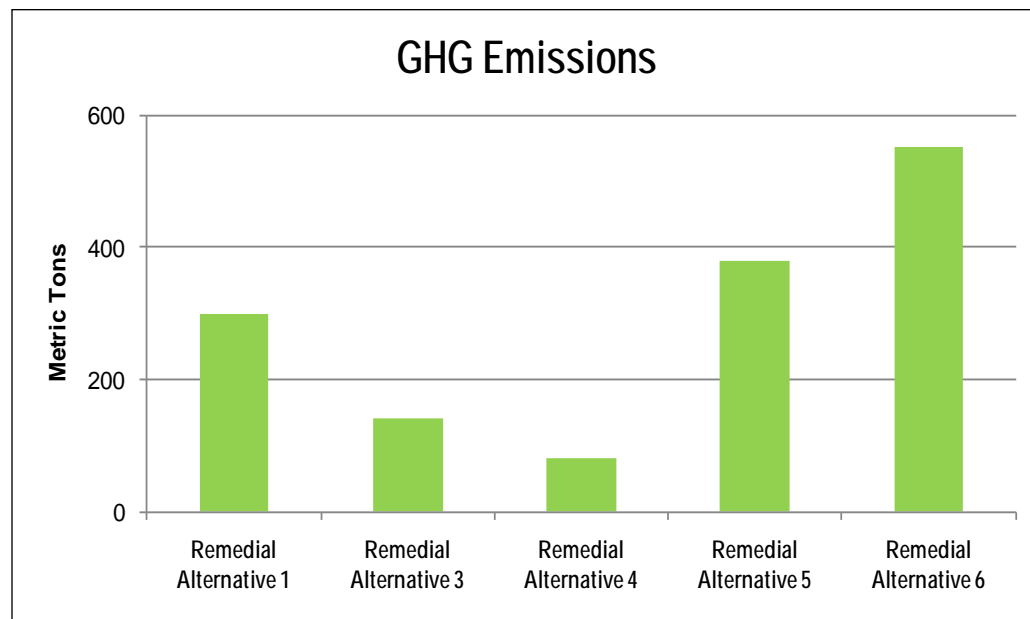
Summary



- A collaborative effort developed by Navy, USACE and Battelle to produce a GSR tool to calculate the environmental footprint of remediation in terms of sustainability metrics.
- Free for public use

- **A user-friendly streamlined life-cycle analysis (LCA) tool that can be applied to any phase of the remedial action**
 - Considers life-cycle impacts such as emissions due to manufacturing of materials consumed during remedial action
- **Transparent calculations to facilitate review by stakeholders/regulators**

- Other tools are also available and can be applied in cases where equipment, materials or metrics are not included in SiteWise™
- SiteWise™ was developed to quantify the effects of remedial actions



Tools & Tracking: NORM Optimization module to include tracking of GSR metrics



Three elements for GSR tracking

1. Identify Green & Sustainable Remediation metrics relevant for environmental footprint of the remedy at this site

2. Briefly describe actions taken to reduce environmental footprint of the remedy

3. Provide estimated % reduction for the following metrics

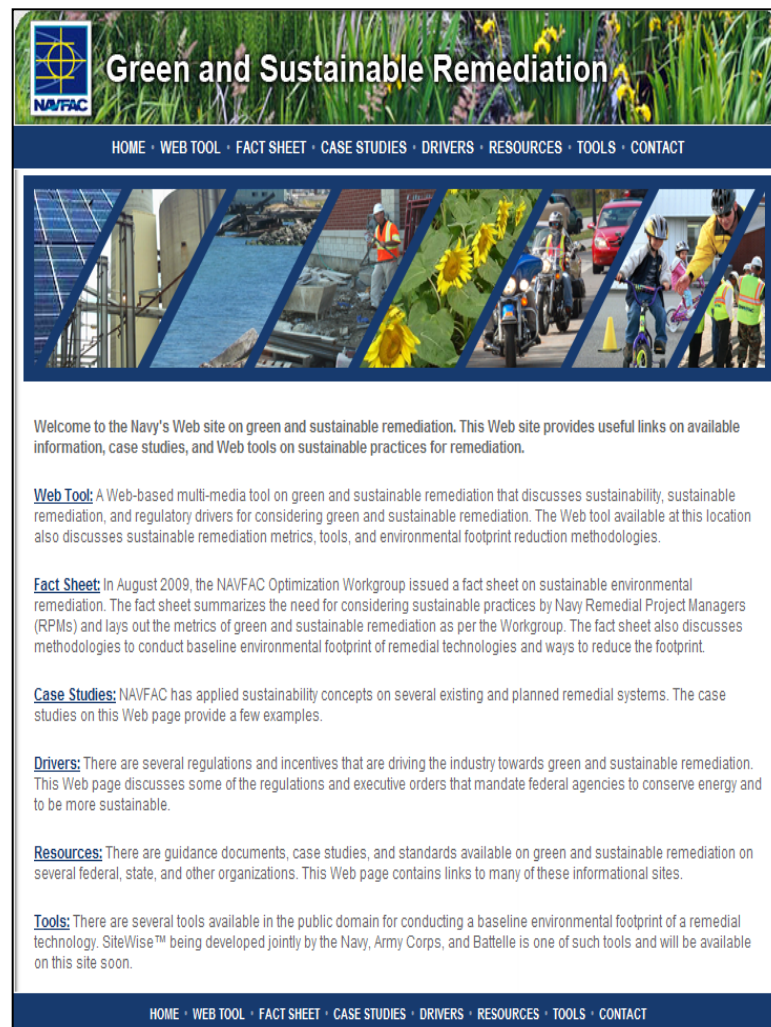
- ☐ GHG
- ☐ Energy
- ☐ Air Pollutants
- ☐ Water Usage
- ☐ Waste Generation

A screenshot of a software interface for the NORM Optimization module. The interface is a form with various input fields and buttons. At the top, there are fields for "Round:" and "Phase:" with a dropdown menu. Below this is a "Review End Date:" field and an "End Date Description:" dropdown. Further down are fields for "Review Cost in Dollars:", "Pot Cost Avoid:", "Pot Implementation Cost:", "Act Cost Avoid:", and "Act Implementation Cost:", each with a "\$0" value. Below these are sections for "Review Description Details:", "Recommendations of Review:", "Actions Taken on Recommendations:", and "Points of Contact:". The "Points of Contact:" section includes a table with columns for "Name", "Phone", and "Email", and buttons for "Add New", "Edit", and "Delete". A large red "DRAFT" watermark is overlaid diagonally across the center of the form.

Resources such as:

- Guidance documents and standards available on green and sustainable remediation
- GSR Fact sheet
- Case Studies
- Drivers
- Tools
- Links Federal, State & other organizations related to GSR.

Access from: www.ert2.org



The screenshot shows the homepage of the "Green and Sustainable Remediation" web portal. The header features the NAVFAC logo and the title "Green and Sustainable Remediation". Below the header is a navigation bar with links: HOME, WEB TOOL, FACT SHEET, CASE STUDIES, DRIVERS, RESOURCES, TOOLS, and CONTACT. The main content area includes a large banner image with various scenes of remediation work. Below the banner, there is a welcome message and several sections with links and descriptions: "Web Tool", "Fact Sheet", "Case Studies", "Drivers", "Resources", and "Tools". Each section provides a brief overview of the content available on the portal.

Green and Sustainable Remediation

HOME • WEB TOOL • FACT SHEET • CASE STUDIES • DRIVERS • RESOURCES • TOOLS • CONTACT

Welcome to the Navy's Web site on green and sustainable remediation. This Web site provides useful links on available information, case studies, and Web tools on sustainable practices for remediation.

Web Tool: A Web-based multi-media tool on green and sustainable remediation that discusses sustainability, sustainable remediation, and regulatory drivers for considering green and sustainable remediation. The Web tool available at this location also discusses sustainable remediation metrics, tools, and environmental footprint reduction methodologies.

Fact Sheet: In August 2009, the NAVFAC Optimization Workgroup issued a fact sheet on sustainable environmental remediation. The fact sheet summarizes the need for considering sustainable practices by Navy Remedial Project Managers (RPMs) and lays out the metrics of green and sustainable remediation as per the Workgroup. The fact sheet also discusses methodologies to conduct baseline environmental footprint of remedial technologies and ways to reduce the footprint.

Case Studies: NAVFAC has applied sustainability concepts on several existing and planned remedial systems. The case studies on this Web page provide a few examples.

Drivers: There are several regulations and incentives that are driving the industry towards green and sustainable remediation. This Web page discusses some of the regulations and executive orders that mandate federal agencies to conserve energy and to be more sustainable.

Resources: There are guidance documents, case studies, and standards available on green and sustainable remediation on several federal, state, and other organizations. This Web page contains links to many of these informational sites.

Tools: There are several tools available in the public domain for conducting a baseline environmental footprint of a remedial technology. SiteWise™ being developed jointly by the Navy, Army Corps, and Battelle is one of such tools and will be available on this site soon.

HOME • WEB TOOL • FACT SHEET • CASE STUDIES • DRIVERS • RESOURCES • TOOLS • CONTACT

Introduction

Incorporating GSR Strategies into Navy Response

Tools and Tracking

➤ Examples of GSR at Navy Installations

- NAS Alameda
- NAWS China Lake, Ca
- Yorktown Defense Fuel Supply Point

Summary

Case Study: NAS Alameda Case Study: Background



- **Naval Air Station closed in 1997, now called Alameda Point**
- **Navy's BRAC PMO San Diego is responsible for remediation of all the sites / OUs.**
- **Sustainability evaluation - remediation alternatives for soil and groundwater at OU 2-C**
- **Battelle conducted the evaluation using SiteWise™**



Case Study: NAS Alameda Case Study : Parameters and Alternative Technologies for Soil Remediation



Parameters:

- **GHG Emissions: CO₂, CH₄, and N₂O as CO₂e**
- **Energy Usage – Electricity and Fuels**
- **Air Emissions - NO_x, SO_x, PM10**
- **Collateral Risk – Fatality and injury from on site remedial activity and off site actions (transportation)**
- **Resources Consumption**
- **Water Usage**

Soil Remediation Alternatives Technologies:

- **S2: 4700 cu yd soil excavation & off site disposal, engineered cap, ICs, &**
- **S3: 23,000 cu yd soil excavation & off site disposal only, ICs, & monitoring**
- **S4: 11,000 cu yd soil excavation & off site disposal, SVE, ICs, & monitoring**

CASE Study: NAS Alameda Case Study: Evaluation Results



GHG Emissions

- Largest contribution to GHG emissions is CO₂ from fuel consumption for equipment use, and transportation of materials
- Alternative S3 has the highest soil excavation volume and GHG emissions ~ 1700 tons

Collateral Risk

- S3 has highest injury risk 25×10^{-2}
- S3 has highest fatality risk 1.1×10^{-3}

Energy usage

- Mostly from transportation fuels
- S3 has the highest energy usage due to transport of large quantity of soil

Air emissions

- Mostly from heavy equipment & transportation
- Largest source is diesel fuel use
- S3 has the highest air emissions

| Alternative | GHG Emissions | Energy Usage | Air Emissions | Collateral Risk |
|-------------|---------------|--------------|---------------|-----------------|
| S2 | Low | Low | Low | Low |
| S3 | High | High | High | High |
| S4 | Medium | Medium | Medium | Medium |

Case Study: Solar-Powered Free Product Recovery, Site 44, NAWS China Lake, CA



- Comparing operation of two types of solar-powered skimmers
- Five wells fitted with Abanaki PetroXractor, and five wells fitted with Geotech Solar Sipper skimmers
- Vendor estimates that each solar-powered unit saves approximately 0.15 lbs of CO₂ per hour of continuous operation compared to electrical powered units
- Both systems have operated effectively for over four months with little maintenance
- The passive skimmer system will result in reduced O&M activities compared to the original mobile product recovery system, resulting in additional remedy footprint reductions



U.S. Navy

Case Study: Yorktown Defense Fuel Supply Point: GSR Assessment During RA Operation



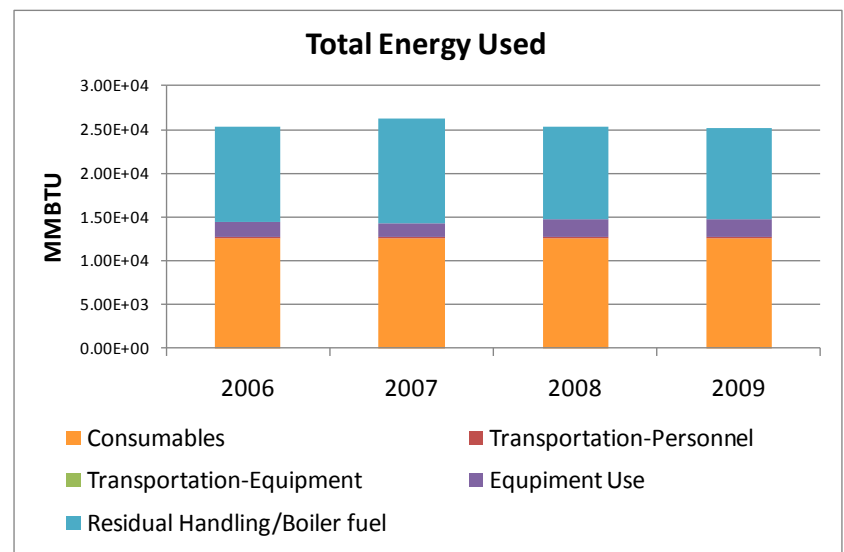
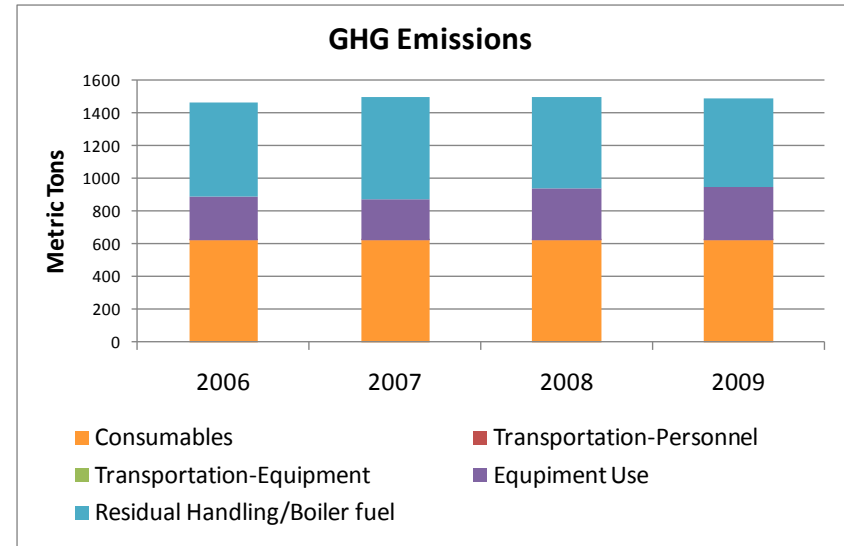
- **Yorktown Fuel Facility**
 - Activated in 1918 with 8 USTs
 - Used for storage of Navy Special Fuel Oil (NSFO)
 - Original NSFO plume estimated at 3-million gallons
- **Remediation System**
 - Thermally enhanced free product recovery
 - Sub-surface heated with closed loop steam and hot water infiltration
 - Product recovery includes 28 trenches and 120 recovery points with skimmer pumps
- **NSFO Recovery**
 - Approximately 2,150 gallons per month and over 400,000 gallons cumulative
 - Annual operating cost of approximately \$950,000



Case Study: Yorktown Defense Fuel Supply Point: GSR Assessment During RA Operation



- **GSR Assessment performed as part of optimization review**
- **Baseline annual footprint determined total footprint for GHGs, energy, criteria pollutants, water consumption and accident risk**
- **Used results to identify high footprint activities**
 - **Electrical energy for equipment operations (e.g. compressor and pumps)**
 - **Fuel for boiler operation**
 - **Consumables (e.g. chemicals for groundwater treatment)**



Case Study: Yorktown Defense Fuel Supply Point: Next Steps



- **Evaluate footprint reduction methods focusing on the high footprint activities identified in baseline assessment**
- **Integrate footprint reduction methods into optimization recommendations**
- **Objective to minimize life-cycle cost and footprint while meeting RA Objectives**
- **Track footprint reduction in Navy's ER database**

Presentation Outline



Introduction

Incorporating GSR Strategies Into Navy Response

Examples of GSR at Navy Installations

Tools and Tracking

➤ **Summary**

- **DON is incorporating GSR throughout the remedial process**
- **Minimize environmental footprint of site cleanups**
- **Navy Optimization workgroup developing resources**
 - Updating optimization policy
 - Developed GSR guidance and updated optimization guidance
- **Remedy selection provides the greatest opportunity to lower the overall remedy footprint**
- **Promote education and transfer of successful solutions through case studies, tools and tracking**

Questions?